Introduction for
JES2 System Programmers

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What you need to know to be a good JES2 Systems Programmer?

- How your company uses JES2.
  - Understand how JES2 supports it
  - Configuration options

- How to keep JES2 alive and healthy.
  - Customized for your environment
  - Available & Secure
  - Well Managed
  - Up-to-date, Maintained, & Well Tested
  - Performing like a Top

References .... (where to turn for help)
**Why do you need JES, anyway?**

- **Enter Jobs, TSO Users, Started Tasks**
  - From local & remote readers, other NJE nodes, offload, internal (programmable) readers
  - Provide temporary storage for I/O files (Spool)

- **Schedule Batch Job Execution**
  - Manage (queue) jobs before and after execution
  - Balance Work between multiple Systems & Nodes

- **Distribute Output**
  - Printers, punches, remotes, NJE nodes, offload, and Programmable interfaces (PSO, SAPI)

- **History ...**
  - Efficiently manage system resources

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**Phases of Job Processing**

Each queue is input to specific JES2 processors (represented by PCEs - Process Control Elements)
JES2 Queuing Mechanisms

- **Job Queuing & Selection**
  - 38 Execution Class Queues (A-Z, 0-9, STC, TSU)
    - Ordered FIFO within Priority (may be Priority Aged - optional)
  - Jobs (JQEs) Selected First-come-First-served by Job Queue PCEs (CNVTs, XEQs, HOPEs, XMITs, PURGs) across the MAS
    - Using $QGET, Work-Select Tables, Exit 49/14, ...

- **Output Queuing & Selection**
  - 110 Output Qs (Hold, NJE, 36 local (A-Z, 0-9), 36 Rmt, 36 Usr)
    - Ordered FIFO within Prty within User/DestID (may be Priority Aged)
  - Output Elements (JOEs) selected First-come-First-served by Output Queue PCEs (PRTs, PUNs, XMITs, FSSs) across MAS
    - Using $#GET, PSO, SAPI, WS Tables (no Exits)

JES2 Multi-Access Spool (MAS)

- "MAS" Complex can have up to 32 Members:
  - Must be in the same Sysplex (Timer, XCF, CDS)
    - Parallel sysplex NOT required (only for Ckpt on coupling facility)
  - Must be "Compatible" (usually + or - 3 Releases)
  - Are Peer-Coupled; no master-slave; Devices anywhere
  - Share Queues by taking turns reading/writing Checkpoint

![Diagram of JES2 MAS complex]
**JES2 has many Parts ...**

### JES2 CSA code (HASCxxx)

- **JES2**: JES2
- **XCF**: XCF
- **JES**: JES
- **INIT**: INIT
- **TSO**: TSO
- **STC**: STC
- **SRM/WLM, SMF, ...**: OS/390 System Services
- **XCF / XES**: XCF / XES
- **OS/390 System Services**: SRM / WLM, SMF, ...
- **SPOOL**: SPOOL
- **Checkpoint**: CKPT
- **Spool Offload, NJE, RJE, FSS**: Readers, Printers, Spool Offload, NJE, RJE, FSS
- **Signaling**: Signaling

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**Customizing your JES2 Environment**

1. **JES2 Init Parms**
   - Take the defaults unless you know differently

2. **JES2 Exits**
   - Requires skills w/ ALC & JES2 Internals
   - MVS Exits (SMF, TSO, PSF) also available
   - Use only when necessary
   - See Session 2662 "JES2 Exits..." (Th. 1:30)

3. **JES2 Table Pairs**
   - Used by many JES2 processes (WS, Init, PCE, ...)
   - IBM, Installation, Vendor tables

4. **JES2 Source Code ...**
JES2 Initialization

- Automatically Started if Primary Subsystem
  - Make your JES2 procedure "bullet-proof"
  - Specify options: 'warm,noreq'

- Initialization Parameters
  - Define size, attributes & status of JES2 resources
  - Use the IBM defaults unless you know better
  - Customer specific processing options & Devices

- Organize your init deck; share it between members
  - Global parms: Spool, Checkpoint, JobClass, defs
  - Devices: Local, Remote
  - System-specific (use &symbolics in a MAS environment)
  - Use INCLUDE & PROCLIB statements new with z/OS R.4 & 5

Sample JES2 procedure

//JES2 PROC DSN1='SYS1.PROCLIB', * PRIMARY PROCLIB *
//                      DSN2='SYS2.USRPROC', * USER PROCLIB *
//                      STEPLIB='SYS1.JES2.SHASLINK', * JES2 PGM LIBRARY *
//                      TYPE=HAS, * DEFAULT NAME ALTERNATE *
//                      PARMSUF=,LOCLSUF=,NJESUF=, * PARM MEMBER SUFFIXES *
//                      MBR=JES2PARM, * EMERGENCY PARMS *
//                      OPT='WARM,NOREQ' * REPLY TO INIT OPTIONS *
//IEFPROC EXEC PGM=HASJES20,DPRTY=(15,15),TIME=1440,
//                      PARM=(&OPT.) * INIT. OPTIONS *
//STEPLIB DD DSN=&STEPLIB,DISP=SHR
//PROC00 DD DSN=&DSN1,DISP=SHR
//PROC01 DD DSN=&DSN2,DISP=SHR
//PROC02 DD DSN=HASPPARM,DISP=SHR
//HASLIST DD DDNAME=IEFRDRD * LISTING FILE *

- Testing the JES2 proc ...
  - "start JES2" on top of an already running JES2 (it won’t get far)
  - Use Poly-JES (more later)
  - See z/OS R.2 - Dynamic Proclibs & Include statements!
PROCLIB & Include statements

- **PROCLIB** initialization statement
  
  ```plaintext
  PROCLIB(xxxxxxxx)  DD(n)=(DSNAME=dsn,VOLSER=volser,UNIT=unit)
  ```

- New operator commands
  
  - `$ADD PROCLIB(xxxxxxxx)`
  - `$T PROCLIB(xxxxxxxx)`
  - `$DEL PROCLIB(xxxxxxxx)`
  - `$D PROCLIB(xxxxxxxx)`

- **INCLUDE** initialization statement
  
  ```plaintext
  INCLUDE  DSNAME=dsn,VOLSER=volser,UNIT=unit
  ```

  - Reduces need to update JES2 PROC

Combining INCLUDE and PROCLIB

- **Simplify JES2 PROC**
  
  - EXEC, STEPLIB DD, one HASPPARM DD
  - Define PROCLIBS via PROCLIB statement
  - INCLUDE additional DD statements

- **In emergency, start JES2 without a PROC!**

  ```plaintext
  S IEESYSAS, PROG=HASJES20, JOBNAME=JES2
  ```

  - Assumes HASJES20 in LINKLIST (no STEPLIB)
  - When HASPPARM allocation fails, reply to
    ```plaintext
    $HASP469
    ```

    - INCLUDE statement(s) for correct init deck(s)
    - PROCLIB statements (if not in init decks)
JES2 Start-up Options

- **Cold-Start (Format)**
  - Was done the very first time your installation started JES2
  - All spooled jobs and data are lost (SPOOL space formatted)

- **All-Member Warm Start**
  - IPL & Restart of JES2 with no other members active
  - Rebuild damaged control blocks (seldom required)

- **Single System Warm Start (or Quick Start)**
  - Single system Restart of JES2 after IPL or JES2 quiesced

- **Hot Start**
  - Restart JES2 after ABEND without an IPL
  - Jobs running before ABEND continue running (may wait on JES2 for TGs, etc.)

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JES2 Init Parms - samples

Use the default values, unless you know better!

Organize them by:
- Global xxxDEF Parms
- Job & Output classes
- Local Devices
- RJE/NJE
- System-Specific
- Operator commands

```
/**************************** SAMPLE JES2 PARAMETER LIBRARY LISTING */
/*************************************************************************/
CKPTDEF CKPT1=(DSN=SYS1.JESCKPT1,VOL=CHECK1,INUSE=YES), ...
SPOOLDEF SPOOLNUM=32,TGSIZE=30,TGSPACE=(MAX=16288),VOLUME=SPL
MASDEF HOLD=30,DORMANCY=(80,500)
BUFDEF BELOWBUF=(LIMIT=1000),EXTBUF=(LIMIT=650)
TPDEF BELOWBUF=(LIMIT=300,SIZE=520),EXTBUF=(LIMIT=500,SIZE=3840)
/* INITATOR, JOB, AND OUTPUT CLASS DEFINITIONS */
 INITDEF PARTNUM=8 /* MAXIMUM NUMBER OF INITS */
 INIT(1-4) CLASS=AFJKE /*INITIATORS 1 - 4 */
 INIT(8-10) DRAIN /*SPARE INITIATORS*/
 JOBCLASS(STC) LOG=NO,OUTPUT=NO,CONDPURG=YES /*STARTED TASK DEF'S */
 JOBCLASS(TSU) REGION=50K,COMMAND=IGNORE,MSGLEVEL=(1,1),CONDPURG=YES
 JOBCLASS(S) PROCLIB=03,HOLD=YES /*SYSTEM PROGRAMMER CLASS */
 OUTCLASS(H) OUTDISP=(HOLD,HOLD),TRKCEL=NO /*SYSOUT CLASS HELD */
 OUTCLASS(X) OUTPUT=DUMMY,TRKCELL=NO /*THROWAWAY CLASS*/
/* NJE/RJE INITIALIZATION PARAMETERS */
 NJEDEF OWNNODE=1,NODENUM=10,LINENUM=15,RESTNODE=10
 LINE(1-3) UNIT=SNA
 NODE(1) NAME=WSCMVS
 NODE(2) NAME=WSCVM
/*************************************************************************/
```
sample JES2 Init Parms (cont'd)

INCLUDE SYSTEM-SPECIFIC PARMS FROM ANOTHER PARMLIB MEMBER

INCLUDE DSN=SYS1.PARMLIB(&SYSNAME.J2P)

OPERATOR DISPLAYS, OVERRIDES, AND COMMANDS

D SPOOLDEF VOLUME
D CKPTDEF CKPT1 /* DISPLAY CURRENT */
D CONDEF CONCHAR /* PARAMETER VALUES */
CONSOLE /* ALLOW OPERATOR TO OVERRIDE */

$S LINE(1-5)
$TLINE(1),TR=YES /*TRACE I/O COMPLETIONS ON LINE1*/
$VS,'V (234,235,236,237),OFFLINE'

END OF JES2 PARAMETER LIBRARY LISTING

JES2 Parameter Changes

■ Most Parms can be Changed or Added Dynamically
  ► $T and $ADD Commands
  ► System Display & Search Facility (SDSF) program product
  ► Keep your init deck up-to-date as you change them.

■ Notable Exceptions (non-dynamic parms):
  ► Hot-Start: PCENUMs, some Device settings
  ► Single-member Warm start (IPL): Exits
  ► All-Member Warm start: CKPTDEF
  ► Cold-start Parms: SPOOLDEF
Availability Issues

■ JES2 System Availability
  ▶ Throughly test all maintenance & exits in all your environments
  ▶ Use JES2 automated restart functions - minimize JES2 down time

■ Reliable Spool (Job input & output, JCL, & Control Blocks)
  ▶ Use reliable DASD (or use hardware duplexing)
  ▶ Minimum volume fencing can limit the damage (but hurt performance)
  ▶ Spool Offload can be used to archive important jobs/SYSOUT
  ▶ Use $SSPOOL; $PSPOOL to add and delete - Never use DFDSS, etc.!

■ Protect your Checkpoints (contain the pointers to all spool data)
  ▶ Always use CKPT1 & CKPT2, NEWCKPT1 & NEWCKPT2
  ▶ Use Reconfiguration Dialog to recover or move - Never use DFDSS!

■ Other operations - wide range of JES2 Commands
  ▶ Watch out for Unauthorized & Dangerous Commands: $PJQ

■ Secure all these with SAF/RACF

JES2 Security

■ Protect System Data Sets (RACF DSNAME profiles)
  ▶ Spool, Checkpoint, Spool Offload
  ▶ Program Libraries, Parmlibs (init deck), Proclibs

■ Use SAF/RACF classes instead of JES2 parms
  ▶ Input Sources - JESINPUT, NODES
  ▶ Job Submission & Cancel - JESJOBS
  ▶ Output Printers & Transmission - WRITER
  ▶ Commands - OPERCMDS
  ▶ Spool Data - JESSPOOL
  ▶ Exits (36, 37) can be used to override, but not recommended

■ See "JES2 Init & Tuning Guide" (chapter 7)
  ▶ Also "RACF Security Administrator's Guide"
**JES2 Systems Management**

- **Systems Management Facility (SMF) records**
  - Controlled by SMF and JES2 parameter settings
    - SMF: SYS1.PARMLIB(SMFPRMxx)
    - JES2: JOBCLASS(x) TYPE6=Y, TYPE26=Yes
  - Job related:
    - Purge (26)
    - Output (6)
    - NJE SysoutTransmission (57)
  - Other:
    - SMF 30 (Common Address Space Work - not written by JES)
    - Start NJE/RJE Line, RMT Signon (BSC - 47, SNA - 52)
    - Stop NJE/RJE Line, RMT Signoff (BSC - 48, SNA - 53)
    - Line or RMT Password Error (BSC - 49, SNA - 54)
    - JES2 Subsystem Start (43), Stop (45)

**JES2 Maintenance**

- **JES2 is "Source-Maintained"**
  - Use SMP/E set-up jobs in SHASSAMP

- **Stay Current on JES2 Maintenance!**
  - Latest RSU level if possible
  - Avoids re-discovery of errors
    - If you have problems, IBM service may want you to get current and re-create problem

- **Read the PSP bucket**
  - Upgrade= ZOSV1R4, Subset= JES2
    - Review HIPERs
Testing - use "Poly-JES"

... also known as "Secondary JES", or "Alternate JES"

- **Configurations: Same MAS as Primary, or Separate**
  - Each subsystem in an MVS system requires a unique ComChar
  - **Member of Primary MAS:**
    - Share Spool, Checkpoint, Queues, ...
    - Load modules usually the same
  - **Separate MAS (Separate NJE Node):**
    - Own Spool, Ckpt, Queues, Load Modules,...
    - Connect to Primary JES via NJE
    - More isolated for "risky" testing

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Debugging

- **Recognizing a Problem:**
  - Messages, Commands, SDSF, Syslog, User phone call

- **Diagnosis - Use these before you need them**
  - Commands/Messages (eg, $HASPO88 ABEND Analysis)
  - $TRACE (IDs) & formatters
  - DEBUG Facility
  - Dumps - IPCS - JES2 Formatters
    - Multi-system dumps (OS/390 Rel. 10)
  - LogRec - SymRecs - EREP
  - CTRACE - under direction of IBM Level 2
  - FSS, GTF, VTAM, NCP, etc. Traces

- See "JES2 Diagnosis" & "JES2 Messages"
JES2 IPCS Support

- You must be proactive: install JES2 IPCS function
  - Make sure JES2 IPCS support works before you need it
  - Set up for all combinations of JES2 and MVS releases

- Use the correct libraries for JES2 control blocks:
  - SHASPARM in the PARMLIB concatenation
  - SHASMIG in the STEPLIB concatenation
  - SHASPNLO in the ISPLLIB concatenation

- For more information, see these books:
  - "JES2 Diagnosis"
  - "JES2 Migration Notebook"
  - "MVS IPCS Customization"

Tuner's View of JES2
Performance

- In general, JES2 takes minimal Resources
  - Exceptions: Large Q's, Many Devices, Exits, OEM subsystems

- Monitoring JES2 Performance
  - SDSF, RMF, $TRACE (1, 2, 17, 20, 30, 31)
  - Main Task CPU utilization detailed with $D PERFDATA cmd
  - Watch "Sympathy Sickness" (delays caused by other members)

- Tuning JES2
  - Spool most important
  - Make sure you have enough resources (TGs, JQEs, JOEs, Bufs)
  - Checkpoint performance is usually not an issue

- Don't worry - be happy
  - Get Baseline #s - Know your "Happy Values"

JES2 Capacity Planning

- As workload grows, so does ...
  - JES2 internal capacity requirements
    - # of Jobs
    - # of Output Elements
    - Spool Space
    - Checkpoint Size
  - JES2 CPU, I/O, & Storage Activity
    - Devices, Initiators
    - Buffers
    - Queue length
  - # of Members in the MAS Complex
    - Spool Contention
    - Checkpoint Contention
    - Systems Management Complexity
Summary

1. Understand the peculiarities of JES2
   ▶ Read and Experiment
   ▶ Test with Poly-JES

2. Keep it simple ...
   ▶ Minimize Mods & Exits
   ▶ Discourage non-standard uses

3. Automate the management of JES
   ▶ Set it up once; keep it up forever

Questions?

- Appendix
  ▶ History of JES2
  ▶ Current Releases
  ▶ Reference Material
    ▶ Books, Websites, etc.
37 Flavors of JES2!

Current JES2 Releases

- **FMIDs, Birthdays & Obituaries**

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<th>JES2 Rel.#</th>
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<th>First Available</th>
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**JES2/MVS Compatibility**

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JES levels supported by a given z/OS release will be the same as the JES levels that can coexist in a MAS.

Support for compatibility mode (R4) withdrawn for z/OS V1.7

JES2 will no longer support compatibility with pre-z/OS V1.2 systems.


- Chapters 4 & 5

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**References**

- **Education:**
  - JES2 for OS/390 Facilities & Implementation (ES710)
- **JES2 Library:** Hard-copy, CDROM, WWW
- **JES2 Source Code:** `xx.SHASSRC` & `xx.SHASMAC`
- **JES2 Samples:** `xx.SHASSAMP`
- **TechDocs:** [www.ibm.com/support/techdocs](http://www.ibm.com/support/techdocs)
- **IBMLink (Q & A), Forums, Listserv-JES2,** ..
- **SHARE Presentations**
- **Other JES2 SysProgs:** SHARE & local user groups, your predecessor!
z/OS JES2 LIBRARY

SA22-7535  JES2 Introduction *
GA22-7538  JES2 Migration
SA22-7532  JES2 Initialization & Tuning Guide
SA22-7533  JES2 Initialization & Tuning Reference
SA22-7537  JES2 Messages
SA22-7526  JES2 Commands
SA22-7527  JES2 Commands Summary
SA22-7534  JES2 Installation Exits
SA22-7536  JES2 Macros
GA22-7531  JES2 Diagnosis
GA22-7528  JES2 Data Areas, V.1 $A - $E *
GA22-7529  JES2 Data Areas, V.2 $F - $O *
GA22-7530  JES2 Data Areas, V.3 $P - $X *

★ SoftCopy only (CD-ROM)

RedBooks @ JES2 . . .

- JES2 Performance & Availability Considerations, REDP-3940
- ABCs of z/OS System Programming Volume 2, SG24-6982
- z/OS Version 1 Release 3 & 4 Implementation, SG24-6581
- z/OS Version 1 Release 2 Implementation, SG24-6235
- Merging Systems into a Sysplex, SG24-6818

More - Search on http://www.redbooks.ibm.com/
z/OS Softcopy Books

- **z/OS Softcopy Collection CD-ROMs**
  - z/OS CD-ROMs: SK3T-4269 (Unlicensed)
    - available on tape (optional, no-charge feature)
  - Software Products: SK3T-4270
  - z/OS & S/W Products - DVD: SK3T-4271
  - Licensed z/OS CD-ROM: LK3T-4307

- **Softcopy site:**
  http://www.ibm.com/servers/eserver/zseries/softcopy

- **Online books at:**
  http://www.ibm.com/servers/eserver/zseries/zos/bkserv

- **JES2 z/OS R6 PDF files:**

- **See what's new:**

z/OS Web Sites

- **z/OS Home Page** (announcement letters, support, coexistence)

- **Planning for Installation**

- **SDSF (Pubs, Presentation, Customization Wizard)**

- **Education**

- **Advanced Tech. Support** (WSC Flashes, etc.)

- **Redbooks:**
  - http://www.redbooks.ibm.com
Questions